

Consumer Perceptions of Product Lifetimes and Labelling: Implications for Introducing a Durability Label

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Handling Editor: Arnold Tukker

Received: 02.12.2022 / Accepted: 13.03.2023
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Abstract

Extending the lifetime of products enables material resource savings and provides an effective resource efficiency strategy within a circular economy paradigm. Although consumer demand for longer lasting products that can be easily repaired has been on the rise, it is not certain that consumers are fully able to identify such products and willing to pay a premium for them. France introduced a mandatory product repairability index in 2021 and plans to introduce a mandatory product durability index by 2024. The reasoning was to allow consumers to benchmark products, and to provide incentives for manufacturers to design durable and repairable products. This initiative would most likely speed up activities for developing a harmonised European Union (EU) labelling scheme to avoid the possibility that various EU countries start their own schemes, which could be problematic for business within the EU single market. However, there is uncertainty regarding how to best display a durability label for influencing consumer choice. This contribution reviews the literature on product durability information and labelling, addressing consumer perceptions on durability labelling and whether the provision of durability information is taken into account in purchasing decisions. Potential implications in durability labelling implementation are discussed, concluding the article with suggestions for overcoming potential implementation challenges.

Keywords: Product Lifetime; Product Durability; Durability Perception; Eco-Label; Consumer Policy; Circular Economy

1. INTRODUCTION

Every day, millions of products are produced, used, and ultimately disposed of around the world, accelerating the rate of material resource depletion and the accumulation of waste (Haberl et al., 2019). This is known as a ‘linear’ economy, expressed by a ‘take-make-waste’ approach. In response to this wasteful and irresponsible practice, a ‘circular economy’ is presented as an alternative approach to disrupt this linear pattern. In a circular economy, resources (i.e. products, components and materials) circulate through successive lifecycles, by extension of product life, repair, refurbishment, and remanufacturing; and finally by recycling of materials (IRP, 2018; Kirchherr et al., 2017).

In a circular economy, waste prevention and the reduction of resource use are considered the most beneficial ways to save resources and energy, and several concepts (e.g. the waste hierarchy, the ‘R’ strategies etc.) have prioritized the extended use of products (Milios & Dalhammar, 2020; Reike et al., 2018). There is an evolving consensus on the importance of extending product lifetimes, particularly for products with significant environmental impacts in the resource extraction and manufacturing phases (Böckin et al., 2020; Cooper & Gutowski, 2017; IRP, 2018). However, empirical evidence reveals that

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the lifetime of an increasing number of products has actually decreased over the last decades (Hennies & Stamminger, 2016; Prakash et al., 2016).

Based on the positive environmental potential associated with longer product lifetimes, the extension of product lifetimes has become a desirable political goal, as exemplified in the European Union (EU) Circular Economy Action Plan (CEAP) and national CE strategies around the world. Therefore, policies promoting longer product lifetimes become essential for realizing the vision of the circular economy (Milios, 2018; 2021).

There is a variety of policy instruments that can be used to influence product lifetimes, but most likely future policy developments will focus on: a) product regulation addressing lifetime and reparability, e.g. regulations set under the Ecodesign Directive (2009/125/EC); b) labelling initiatives to inform consumers about expected product lifetime and repairs, e.g. under the Energy Labelling Framework Regulation (Regulation (EU) 2017/1369), and/or through a new labelling scheme or under existing eco-labels; and c) new consumer legislation and initiatives (Maitre-Ekern & Dalhammar, 2016). Mandatory ecodesign standards may be suitable for certain product groups, but less relevant for other product groups. This applies especially to products that are still under rapid technological development, or when it is complicated to set concrete ecodesign requirements. There are also alternatives to ecodesign regulations, such as consumer laws, labelling and public procurement, which could be more relevant in some cases than ecodesign requirements; for instance, for products that are hard to regulate due to problems in measuring lifetime, or lack of appropriate standards for showing legal compliance (Dalhammar et al., 2018).

Despite the use of mandatory regulatory approaches to impose product life extension measures to producers, a very important parameter that needs to be addressed is the behavioural aspects of consumers. If regulation pushes for the design of very durable products but consumers still choose to discard them while still fully functional, this is a case of over-engineering and a waste of valuable resources that producers have used to make products more durable (Dalhammar, 2016).

Consequently, an appropriate policy approach in this case is the introduction of a (mandatory) product lifetime label. Research has shown that consumers often require better information on the lifetime of products (Cooper, 2004; Cox et al., 2013). Information asymmetries between the producers and consumers are very likely to arise if there is no reliable information on a product's expected lifetime. These asymmetries may cause an adverse selection mechanism that results in high-quality products to be pushed out of the market (Akerlof, 1970). This situation could be addressed by providing consumers with reliable information about expected product lifetimes through e.g. labelling (Sammer & Wüstenhagen, 2006). A product lifetime label could assist consumers in distinguishing between products with different lifetimes, thus facilitating their potential preference for longer lasting products (Jacobs & Hörisch, 2021).

This contribution explores the perceptions of consumers in relation to the introduction of a durability label for products. By reviewing the literature on relevant empirical studies, this contribution identifies potential effects of such labelling on consumer choice and discusses implications on the potential implementation of a durability label as a policy intervention to extend the life of products, within a circular economy.

The next section presents a theoretical background on the ways consumer choice can be affected by eco-labelling, and the general understanding and consumer perceptions of product durability. Then, a brief description of the methodological approach is provided in section 3. In section 4, the results of the research are presented, and in section 5, the findings enable the discussion of the potential implications of a mandatory durability label. The article concludes in section 6 with the main outcomes and recommendation of the research.

2. RESEARCH BACKGROUND

2.1. Product labelling and consumer choice

One goal of consumer policy is to give consumers the power to make informed choices by means of providing accurate and trustworthy information (Thøgersen, 2005). Product labels inform consumers and indicate the desired or undesired properties that a product possesses. Eco-labels are the only direct

way for consumers to obtain information on the environmental impact of products at the store. Consumers rely on labels to fill their information gap about the product and to gain understanding of the environmental impact of what and how they consume (Sircome et al., 2016). Eco-labels can be mandatory for producers, such as the EU Energy Label and the French repairability index, or voluntary, such as the EU Flower, the Nordic Swan, and the German Blue Angel.

Environmental labelling and related information tools can assist consumer decision-making, but studies have shown that consumers can be confused by the diversity and sheer amount of information (Leire & Thidell, 2005). Thus, the effectiveness of eco-labels depends both on the way the information is presented and on the ability of consumers to understand that information and accordingly act on it. Moreover, irrespective of the receptiveness of the displayed information, the eco-label needs to be trusted in order to avoid the phenomenon of ‘greenwashing’ which might induce a negative disposition in consumers (van der Ven, 2019).

In theory, there is a number of preconditions that needs to be fulfilled for an effective implementation of a labelling scheme. Firstly, a fundamental precondition for the successful implementation of labelling is that consumers trust the assigned eco-label. For building up trust, it is essential to involve a commercially independent third-party organisation and a variety of relevant stakeholders, both deemed critical for the future uptake of a labelling scheme (Horne, 2009; Sircome et al., 2016). A legally mandatory labelling scheme could be a preferable option, instead of a voluntary label, since these usually have broader recognition and support among consumers and deliver a level playing field for producers (Horne, 2009). Governmental involvement generally improves uptake, and governments can use eco-labelling in addition to other policy mechanisms, such as procurement policies to support the eco-label schemes (Magnadóttir et al., 2017; Gåvertsson et al., 2020).

Secondly, it is important that consumers can recognise and understand the label and its message (Van Dam & Reuvekamp, 1995). One critical aspect is to remove any potential uncertainty about the meaning of a label, or the issuing authority. In general, consumers can better recognise and accept simple eco-labels that directly convey the intended message (Sircome et al., 2016). However, overly simple labels may undermine the efficacy of the environmental claims (Horne, 2009).

Lastly, the design of eco-labels can directly affect its understanding and therefore its trustworthiness. Eco-labels come in a variety of designs that use both imagery and text. Textual and graphical elements of eco-labels can each influence independently the choice of consumers, but the combination of both elements in the label elicits greater effectiveness and willingness to pay (Tang et al., 2004). Displaying quantitative information on a label does not appear to have any significant impact on a label’s credibility (Teisl et al., 2008).

However, the provision of information does not always lead to changes in attitudes, and even when it does, these changes do not always translate to behavioural change (Mont & Power, 2010). Much of everyday consumption happens around habitual practices and norms (McKenzie-Mohr & Smith, 1999). Thus, potential changes in habits of consumption may not result directly from the displayed eco-labels (Horne, 2009). To overcome this behavioural inconsistency there are several ways in which information provision could complement eco-labelling and lead to behavioural change. The information provided must incentivise the creation of positive attitudes that in turn may lead to a behavioural solution. This means that consumers not only need to gain knowledge about a certain issue, but also to be given the right information on how to personally deal with this issue (Sircome et al., 2016).

Consumer responsiveness to labels also depends on demographic characteristics (Boyer et al., 2021). Income levels are consistently associated with the willingness to pay for eco-labelled products. The higher the disposable income, the higher the willingness to pay for eco-labels (Sønderskov & Daugbjerg, 2011). Typically, female consumers are more willing to pay higher premiums for eco-labelled products than males (Harms & Linton, 2016). Age appeared to be an important parameter in some studies, although the results were inconclusive (Ward et al., 2011). Finally, the level of education attainment can be an indicator of higher uptake of eco-labels, as well as the general knowledge of consumers regarding environmental issues and prior environmentally responsible behaviour (Sircome et al., 2016). However, it is rather difficult to have a consistent indication on the aggregated influence of all the demographic characteristics presented above, as their causal associations within and across other socio-economic variables remain a topic for further research (Skylark & Callan, 2021).

2.2 Consumer perception of product lifetimes (durability vs. obsolescence)

Consumers' expectations of product lifetimes are widely different, as it is not always obvious what a durable product is, and how long a product is expected to last. The notion of product lifetime is a combination of (a) the time consumers expect a product to last before it breaks/malfunctions, and (b) the time consumers want a product to last before they dispose or replace it (Cooper, 2004). These two characteristics, i.e. the functional life of a product and the willingness to keep it, influence consumers' attitudes and ultimately affects a product's actual 'in use' lifetime. Generally, consumers want products to last (i.e. not break) for just as long as they want to keep them, but not necessarily any longer than that (Cox et al. 2013).

This highlights the different ways consumers understand durability in products. Braithwaite et al. (2015) found that the meaning of durability varies among consumers, and that it is usually associated with products that have lifetime guarantees or include parts that can be easily repaired and/or updated. The perception of product durability is also linked to a product's performance over time, also called 'functional reliability'. Functional reliability is deemed very important for all products (even the ones expected to be kept for a short time), but durability is primarily valued for products that consumers expect to keep for a long time (Cox et al., 2013). Moreover, durability is perceived as the timeframe a product provides a useful service (Knight et al., 2013).

Durability is not an attribute that the consumers consciously consider at the point of purchase, but they usually make use of proxies, e.g. product quality as an indicator of the potential lifespan. Relevant proxies, such as brand and price, help consumers to assess how long a product will last (Cooper, 2004). According to Knight et al. (2013), consumers expect that the number of years of product use would be an indicator of durability. Consequently, by communicating the number of years that an appliance may last, there could be a potential shift in consumer behaviour towards the care and maintenance of products, since the consumer would treat the product as having a longer service life. Moreover, it was observed that the manufacturers' guarantees are also important as a sign of functional reliability, which is linked to durability.

There are several reasons for discarding a product in use, and they are directly related to different types of perceived product obsolescence and the willingness of consumers to replace the product. The types of perceived product obsolescence include technological, aesthetic, psychological, quality, economic, ecological, social, and legal reasons (van den Berge & Thysen, 2020). Van Nes & Cramer (2005) presented four reasons that may lead to the discarding or replacement of products: (1) 'wear and tear' when a product is broken or does not function anymore; (2) 'improved utility' when the product does not function satisfactorily due to improved use demands; (3) 'improved expression' when the product does not function satisfactorily due to comfort/quality/expression reasons; and (4) 'new desires' when the product functions satisfactorily but is nevertheless replaced due to the desire for additional product characteristics in newer products. For an overview, see Table 1. Commonly, it is the combination of several reasons of product obsolescence that eventually leads to the decision of discarding a product (Cox et al., 2013). For example, a laptop can be replaced due to a combination of reasons, such as a weak battery, worn-out exterior, and because a newer version of hardware/software is available, thus justifying the decision of replacing/discarding the laptop.

Table 1. Product replacement reasons and their relation to types of obsolescence.

Replacement reasons	Related to	Type of obsolescence	References
Wear and tear	Product functionality and performance	Quality	Mugge et al., 2005; Guiltinan, 2009
Improved utility	Value depreciation of the 'old' compared to the 'new' product	Economic	Cooper, 2004; Khan et al., 2018
	The ecological footprint of the 'old' product compared to the 'new' product	Ecological	Wilson et al., 2017
	Social norms of products and its use	Social	Burns, 2010; Wilson et al., 2017
	Legislations around products	Legal	Maitre-Ekern, & Dalhammar, 2016 Mugge et al., 2005
Wear and tear and/or improved utility, improved expression	Technological innovation or developments	Technological	Cooper, 2004
Improved expression, new desires	Product appearance (trends in design, signs of wear and tear)	Aesthetic	Cooper, 2004
	Social influences (status, peer pressure) and symbolic value of products	Psychological	Burns, 2010; Cooper, 2004; Wilson et al., 2017

Consumers in general prefer durable products, but the relatively high price that is usually associated with durable products might prevent them from purchasing such products (van den Berge & Thysen, 2020). Moreover, consumers appear willing to repair their products for extended periods of time, however, this willingness is affected negatively by factors associated to the cost of repair and its relation to the initial purchasing price of the product, the perceived value remaining in the product, the uncertainty of the repair outcome, and the timeframe the product is expected to last before another repair is needed (van den Berge & Thysen, 2020). There is also evidence that consumers experience that products do not really last as long as they should (Cooper, 2004; Echegaray et al., 2016; Wieser & Tröger, 2018), indicating a rising awareness of built-in planned obsolescence in products (Kahlin McVeigh et al., 2019). However, in most cases obsolescence is not “planned” per se by manufacturers but is a function of market conditions such as time pressures and short testing periods (Longmuss & Poppe, 2017), and that is why the term ‘premature obsolescence’ is increasingly used instead of ‘planned obsolescence’.

On the other hand, the increasing prevalence of cheap products (usually of lesser quality) on the market reinforces a constantly “updating” mind-set that renders durable products as semi-disposable (Cox et al. 2013). To extend product lifetimes there is a need for change in the consumer environment, so that consumers begin to feel they have the right information to make their purchasing decisions, and that they are not locked-in to a “throw-away” consumerist culture.

3. METHOD

The research set out to investigate what elements of eco-labelling are particularly important for the understanding and uptake by consumers, regarding the durability of products. The research method used for exploring this objective comprised of a scoping literature review by identifying relevant documents and analysing previous research and findings on this topic. The aim of a scoping literature review is to identify and map the body of literature on a specific topic area (Arksey and O'Malley, 2005), in contrast to the aim of a systematic review which is to synthesize and conclude on the extant literature regarding a specific research question (Munn et al., 2018). In a scoping review, usually the overview of a diverse body of literature is presented, generally including a wide range of research designs and methodologies (Levac et al., 2010) across diverse disciplinary backgrounds (Pham et al., 2014). Finally, and most

importantly, scoping reviews provide a descriptive overview of the reviewed material without individually assessing the reviewed studies, or synthesizing concepts and frameworks from the literature sources (Arksey and O'Malley, 2005; Levac et al., 2010; Pham et al., 2014).

The literature review commenced with searching for relevant scientific publications in major scientific databases such as Scopus and Google Scholar. The selection of keywords was deliberate and exclusive so that only the most relevant to the topic articles could be retrieved. The topic of durability labelling is under-researched and quite “new” in the field of research and policy (ADEME et al., 2021), therefore, the aim of this research was to focus only on exploring this particular topic and not include extensive literature on well-established topics such as eco-labelling in general.

The initial set of keywords included ‘durability’ AND ‘label*’, which was expanded to include similar to durability terms such as ‘lifetime’ and ‘lifespan’. Since the objective was to narrow down the literature only to relevant articles, the search of the general term ‘eco-labelling’ was avoided, and the term ‘label’ was searched only in conjunction with that of ‘durability’ and the related terms. Although the durability of a product could also be characterised in relation to its repairability potential (Maitre-Ekern & Dalhammar, 2016), in this research the term ‘repairability’ was also avoided since it represents a different set of consumer perception criteria that are not identical to the ones in literature about durability (see section 2.2).

The search for scientific articles returned a very low number of peer-reviewed articles on this topic (n=2) which meant that the search was inevitably expanded to grey literature (e.g. commissioned studies, industry studies, advocacy papers etc.). Taking this step, the search retrieved a reasonable number of documents that allowed a structured literature review (n=12). All the documents comprised studies that were examining quantitatively and/or qualitatively empirical experiments on consumers (e.g. choice experiments, surveys, interviews etc.).

The sample of the studies was sufficient and satisfactory to describe the phenomenon of consumer perception on durability labelling and could provide insights to the objective of this research. The content of each document was summarised and qualitatively analysed using a synthesis matrix to identify common themes and significant inferences.

4. RESULTS

Even though durability labelling is considered as a major enabling factor for consumers to choose more durable products (Cooper & Christer, 2010; Gnanapragasam et al., 2017), only few studies have analysed consumers’ purchasing preference in the presence of product durability information, and the effects of a potential durability label. Just over ten dedicated studies (publicly available – excluding private industry studies) have been identified in literature, which include consumer experiments/surveys aiming at developing knowledge about the consumers’ purchasing decisions and willingness to pay for durable, long-lasting, products. The analysis of these studies yielded a few overarching themes, which are presented in the following sub-sections.

4.1 The display of durability information influences positively the purchasing decision of consumers.

The results of the reviewed studies, that tested different ways of displaying product durability information on consumers and in a variety of product groups, showed that durability labelling generally influences the purchasing decision of consumers in favour of products with longer lifespans (Artinger et al., 2018; GfK, 2017; Jacobs, 2018; Jacobs & Hörisch, 2021; Knight et al., 2013; LE Europe et al., 2018; Sircome et al., 2016; Swaen et al., 2014; 2018). For instance, in one study by GfK (2017), when no durability information was provided the products were selected by 27% of the respondents, while 47% of the respondents chose the same products in the presence of durability information.

The level of this influence, however, is dependent on the type of product. Knight et al. (2013) found that consumers’ durability considerations when purchasing new products might differ, as consumers might give greater weight to a product’s lifetime when purchasing a new product depending on how likely it might be for the product to break down. For example, vacuum cleaners, smartphones, and laptops are expected to break down more easily than fridges, ovens and televisions. Among the product

groups that durability labelling seems to play a significant role are suitcases and printers, while the influence of the label on smartphones appears to be the weakest (Sircome et al., 2016). The latter can be explained by the fact that the majority of consumers expect a rapid development of new, technologically advanced, models to come out soon, and therefore the longevity of the current appliances is not a desired attribute. The fast-evolving technology of smartphones does not encourage consumers to seek durable devices – at least with a product lifetime of, typically, more than three years (Sircome et al., 2016).

Jacobs and Hörisch (2021) showed that product durability information positively influences purchase decisions, confirming results of previous studies. However, they highlighted that the positive effect of product durability labelling is not linear, but it is decreasing with higher levels of a product's lifetime. For instance, indicating a product would last 25 instead of 20 years has a lower influence on consumer choice than indicating a product would last 10 instead of 5 years.

Another significant finding that was highlighted by Sircome et al. (2016) is that displaying a durability label on a product always influences positively the purchasing decision of consumers, regardless of the price. Moreover, durability labelling appears to have a higher influence on purchasing decisions relating to high-end products, compared to low-end products. However, the difference between these types of products was not significant, and therefore no strong conclusions could be drawn about this type of interaction of the label.

In relation to the market reputation of brands (i.e. high-quality, durable etc.), Jacobs and Hörisch (2021) revealed that introducing a durability label renders the positive purchase influence of such brands less impactful. This may come as a result of reducing the information asymmetry between consumers and manufacturers regarding a product's durability. Therefore, the proxies that consumers routinely use to determine the quality of a product, such as the quality image represented by high-end brands (Knight et al., 2013), would become increasingly irrelevant due to the provision of transparent product lifetime information.

4.2 Durability information influences positively the willingness to pay a higher price for purchasing more durable products.

In the available literature, it is observed that consumers are prepared to pay a higher price for a product that has a lifespan two years longer in comparison to a similar product without an extended lifespan (GfK, 2017; Sircome et al., 2016). Also, in the presence of durability information, consumers are on average willing to pay a higher price – 5% more compared to a baseline price – for products with higher durability (GfK, 2017).

Pilot studies by Swaen et al. (2014; 2018) showed that durability labelling has a positive effect on consumers towards the perceived quality of a product, especially for low-priced products, but has no significant impact on the willingness to purchase, slightly contrasting the study by GfK (2017) which identified a marginal increase in willingness to pay. However, the empirical findings were not coherent across all the product categories, the different types of labelling, and the profiles of consumers that participated (Swaen et al., 2018).

4.3 Durability information increases the perception of quality of a product, and it is generally preferable to repairability information.

Consumers largely associate durability with product quality (LE Europe et al., 2018; Sircome et al., 2016). Durability is found to be more important than repairability, as consumers indicate a trust in manufacturer warranties, thus not expecting a durable product to break within the indicated warranty period (LE Europe et al., 2018).

In a recent study, van den Berge et al. (2021a) interviewed a sample of consumers to identify how do they estimate product lifetimes, and attitudes towards repairability and a product lifetime label. The results showed that consumers cannot make well-informed estimations about a product's lifetime, and usually they perceive negatively product repairability information, meaning that a more “repairable” product might indicate that it needs frequent repairs (i.e. lower quality product). Moreover, consumers

were concerned about the use intensity and use behaviour associated with a product and how these can be considered on a durability label.

4.4 Durability is among the top three attributes of a product that positively influence purchasing decisions.

A study about the EU Energy Label, on behalf of the German regional authorities, provided useful insights on the importance of durability information in purchasing decisions for electric and electronic equipment (Dünnhoff & Palm 2014). The participants in this study were asked to rank the importance of several factors (incl. energy efficiency, durability, price, etc.) that affected their purchasing decision during their last purchase. Although the most important factor for consumers was the electricity consumption of a product and its energy efficiency, durability was placed in the second position, being more important than price and other parameters that were included in the study. On the other hand, the price of the product had the highest relative influence on purchase decisions in another German study by Jacobs and Hörisch (2021), followed by energy consumption, product lifetime, equipment version and brand. The participants of an EU-wide study (LE Europe et al., 2018) regarded the quality of a product as the most influential parameter in their purchasing decisions, followed by the price and the expected time (durability). The product manufacturer or brand was rated as less influential factors, while parameters such as trends and fashion were regarded as even less influential.

The influence of durability information is related to the price of products, and consumers consider such information even more relevant than information on energy consumption or brands (Jacobs & Hörisch, 2021), similar to the findings of Knight et al. (2013). Based on the analytical framework of Jacobs' (2018) pilot study, the preference for durability is driven by both the sustainability values of consumers and their 'rational' egoistic motives, e.g. money saving, making the price and lifetime (as the proxy of quality) of a product the most influential characteristics in purchasing decisions.

4.5 In demographic characteristics, a female consumer aged 20-35 is more likely to be positively influenced by the presence of a durability label.

Although durability labelling appears to have an impact on both men and women, women are more likely to rely on the label for their purchasing decisions, as documented in two studies that looked into demographic characteristics (Jacobs & Hörisch, 2021; Sircome et al., 2016). A durability label influences the purchasing decisions of all age groups, however, the most receptive individuals are found to be younger than 35 years old – between 25-35 in the study by Sircome et al. (2016) and in the 15-29 years old bracket in the clusters of demographic groups studied by Jacobs and Hörisch (2021). People older than 35 years old are increasingly less influenced by durability information (Jacobs & Hörisch, 2021; Sircome et al., 2016).

4.6 A durability label displaying the lifetime of a product in a time unit is preferable.

Regarding the way durability information is displayed, one study highlighted the fact that presenting durability information in the number of years of expected life of a product has a slightly higher impact than in units of use intensity, e.g. the number of wash cycles, etc. (GfK, 2017). The same conclusions are drawn in the study by Sircome et al. (2016), in which the lifespan label displaying a time-period (months, years) was the one understood best by the participants. It was noted that individuals find it difficult to process – and therefore fully understand – large quantities, e.g. when durability is expressed in working hours, or wash cycles, etc. (Sircome et al., 2016). However, research has shown that lifetime expectations potentially affect product replacement decisions (van den Berge et al., 2021b). So, displaying a minimum number of years on the product label could unintentionally encourage consumers to replace still functioning products when the indicated years (lifetime) are exceeded (van den Berge et al., 2021a).

4.7 Third-party independent durability labelling increases consumer trust

Jacobs and Hörisch (2021) argue that durability information should be framed as being issued by an independent third-party actor using a standardised test procedure, rather than a non-binding estimate of the manufacturer, as tested in other studies (e.g. Artinger et al., 2018). This is because consumers' trust in sustainability labels is considerably higher when the label is issued by independent organisations rather than by the companies themselves, as it is widely documented in literature (Ertz et al., 2017; Horne, 2009; van den Berge et al., 2021a).

5. DISCUSSION – Implications for durability labelling

The results of the literature review indicate a positive impact of durability labelling on consumers. However, several implications arise in relation to the design and implementation of a durability label. The influence of durability information is often product dependent, as labels that work on one product group may not work on a different product group. Understanding the aspects of the information that can be universally applied across all product categories – in contrast to product-specific information – would be important for an effective implementation of a durability label. A one-size-fits-all horizontal approach is unlikely to be appropriate since different approaches are suitable for different products (Marcus et al., 2020).

In terms of environmental objectives, extending product lifetime not always has positive results. Impacts across the production, use and end of life of a product need to be addressed and communicated, as there are usually trade-offs between the different phases of a product's lifecycle (Richter et al., 2019). Considering the design of an environmental label, it can be quite simple, for instance by indicating the level of impact in a selected environmental category, or using an aggregate indicator (e.g. environmental footprint). When it comes to durability labelling, the situation could indeed prove to be quite complicated, especially for assessing the environmental impacts of products during their lifespan, and how this can be communicated on the label. For instance, if product "A" has a lifespan twice as long as product "B", then for a certain functional unit (e.g. 50 use-cycles), the environmental impact of product "B" will be twice as high as that of product "A". In the meantime, no universally agreed standard exists for assessing product lifespans (Fangeat & Chauvin, 2016).

The availability of durability information interacts with price sensitivity across different consumer groups. Price was often regarded as the most influential factor in consumer choice across all product categories (Jacobs & Hörisch, 2021; Knight et al., 2013). Price was also a highly influential factor in purchasing decisions in relation to environmental information. However, no evidence was established as to what would be the limit of premium people were willing to pay for the purchasing of labelled products. If consumers place a high importance on the price of a product, then the influence of environmental information on the consumers' choice significantly diminishes (Brocklehurst et al. 2019). On the other hand, consumers often have limited information about product lifetimes and the total cost of ownership of products (i.e. the cost of maintaining and upgrading the product for its entire lifespan, in addition to the initial purchase cost) (Marcus et al. 2020). Thus, the impact of displaying the lifetime cost of a product could be much greater than just displaying environmental information. For example, a case of displaying the total cost of a product would look something like that: a product designed to last for 5 years, and it is sold for 100 EUR, would really have a cost of 20 EUR per year. In addition, potential consumables associated with the product, the electricity consumption, as well as the potential water consumption, could also be included in the displayed "use cost" on the label. While such an approach could have a significant influence on consumer choice, it would be actually quite complicated to calculate such a "use cost" (Fangeat & Chauvin, 2016).

In practice, it is important to carefully design a durability label, and ideally, a labelling scheme should be accompanied by relevant education campaigns to inform consumers how to read and understand the label (Sircome et al., 2016). However, the standard lifetime of a product may not consider the availability of spare parts and thus it would not accurately reflect the actual operating life of the product (Fangeat & Chauvin, 2016). Furthermore, it would be preferable to avoid displaying the normative lifespan of a product in number of years, but rather in a number reflecting the operating hours or number of use-

cycles, in contrast to what the reviewed literature has showed. This is because there is a chance that consumers might confuse the display in years with the legally applied warranty, as provided by manufacturers, which is also expressed in number of years, and thus they would be dissatisfied if their product breaks down before the indicated period.

Consequently, it would be preferable to include further criteria in a durability label that would extend durability considerations by e.g. the availability of spare parts, repairability potential, and the evolutionary technological aspects of products. This could provide a more accurate estimation of the effective lifetime of a product. For the credible and effective implementation of a durability labelling scheme, it would be necessary to involve all the relevant stakeholders for the co-development of the appropriate methods and criteria of durability. However, some resistance might be observed by a certain segment of manufacturers who perceive the labelling of durability of products as a threat to their existing business model. Therefore, it is equally important to convince manufacturers that durability could be a competitive advantage for their business, and that it is commercially viable (Knight et al. 2013).

Finally, it has been observed that exposure to different types of existing eco-labels creates a cognitive precedence in the decision-making process of consumers – the so-called ‘spill-over’ effect – irrespective the type of information or the design of the label (Leenher et al. 2014). The spill-over effect can be described as the propensity of people to adopt a similar decision thought-process in a situation after seeing an existing eco-label, to the extent that the effective (distinguishing) elements on the label of one product can also be used on the label of another.

For example, energy information in the form of a colour scale together with capital letters, indicating the energy class of a product (e.g. EU energy label), has been used extensively and has been proven an effective tool in driving consumer choice (VHK, 2016). However, it is not certain that a similar design for indicating the durability of a product could be accurately perceived by consumers. Although exposure to a similar label like the EU energy label, would make the scale of measurement easily recognisable and would prompt a “right” or “wrong” choice, it might confuse consumers regarding what attribute of the product the label is measuring (Leenher et al. 2014).

6. CONCLUSIONS

This contribution reviewed existing literature on consumer perceptions towards a potential eco-label that reflects the lifetime of products and how this could influence consumer choice and the potential of extending the product lifetimes in use and on the market. Based on the review findings, several implications of the characteristics of such a label were discussed and alternatives proposed.

The results of the study showed that durability labelling can be an effective way to inform consumer choice in the marketplace, but the increasing number and diversity of different labelling systems can create confusion. Therefore, a durability label must be designed in a way that is understood by the public and be able to instil a sense of trust to the consumers. The information must send a clear signal and encourage “environmentally positive” behaviour, taking into account the specificities of different demographic groups (e.g. gender, age and level of education). Also, information about product durability can increase consumers’ willingness to pay for more durable products, as durability is among the top three most important factors for consumers when considering of buying a product.

The most appropriate way to express the life of a product would not be in number of years, as this may confuse consumers in relation to its legal warranty and commercial guarantees, which are expressed in number of years as well. Also, this expression does not consider the use intensity and user behaviour in relation to the product. A more fitting approach would be to use the ‘number of operating hours’ or ‘number of cycles’ of products. Currently though, there is no universally agreed standard for assessing accurately product lifespans.

Finally, for the effective application of labelling initiatives it is important to provide further supportive measures; for instance, relevant educational information so that consumers can absorb the message and use the labelling in a proper way. Also, the use of a durability label in conjunction with other policy instruments (e.g. Public Procurement) could increase its effect in enabling the proliferation of longer lasting products in the market. Thus, durability labelling could be a powerful instrument within a broader policy mix for a circular economy transition (Milios, 2021) that encourages the longer and more effective use of products and contributes to material resource savings and less environmental impacts from the production, use, and final disposal of products.

DECLARATIONS

Competing interests The author declares no competing interests.

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REFERENCES

- ADEME, In Extensio Innovation Croissance, & Fraunhofer IZM, 2021. Preparatory study for the introduction of a durability index. <https://bibliothèque.ademe.fr/dechets-economie-circulaire/4853-preparatory-study-for-the-introduction-of-a-durability-index.html> (accessed 23 July 2022).
- Akerlof, G.A., 1970. The market for “lemons”: Quality uncertainty and the market mechanism. *The Quarterly Journal of Economics*, 84(3), 488–500. <https://doi.org/10.1016/B978-0-12-214850-7.50022-X>
- Arksey, H. & O'Malley, L., 2005. Scoping studies: towards a methodological framework. *International Journal of Social Research Methodology*, 8(1), pp.19–32. DOI: 10.1080/1364557032000119616
- Artinger, S., Baltes, S., Jarchow, C., Petersen, M., & Schneider, A.M. (2018). Lifespan label for electrical products: Study on the effect of lifespan information for electrical products on the purchasing decision. <https://www.bundesregierung.de/resource/blob/1541604/323454/046091a8ccdc126cdf3e827ed0c27c2/en-lebensdauer-downloadbericht-data.pdf?download=1> (accessed 17 July 2022).
- Brocklehurst, F., Whittle, C., McAlister, C., & Whitmarsh, L., 2019. Can the provision of energy and resource efficiency information influence what consumers buy? A review of the evidence. In ECEEE 2019 Summer Study on Energy Efficiency: Is Efficient Sufficient? 1621–1630.
- Böckin, D., Willskytt, S., André, H., Tillman, A.-M., & Ljunggren Söderman, M., 2020. How product characteristics can guide measures for resource efficiency – A synthesis of assessment studies. *Resour. Conserv. Recy.* 154, 104582. <https://doi.org/10.1016/j.resconrec.2019.104582>
- Boyer, R.H.W., Hunka, A.D., Linder, M., Whalen, K.A., & Habibi, S., 2021. Product Labels for the Circular Economy: Are Customers Willing to Pay for Circular? *Sustain. Prod. Consum.* 27, 61–71. <https://doi.org/10.1016/j.spc.2020.10.010>
- Braithwaite, N., Densley-Tingley, D., & Moreno, M., 2015. Should energy labels for washing machines be expanded to include a durability rating? PLATE 2015 Conference Proceedings. http://irep.ntu.ac.uk/id/eprint/8546/1/220134_PubSub2377_Moreno.pdf
- Burns, B., 2010. Re-evaluating obsolescence and planning for it. In T. Cooper (Ed.), *Longer lasting products—Alternatives to the throwaway society*, 39–60. Farnham, UK: Gower.
- Cooper, R.D., & Gutowski, T.G. (2017). The environmental impacts of reuse: A review. *Journal of Industrial Ecology*, 21, 38–56. <https://doi.org/10.1111/jiec.12388>
- Cooper, T., 2004. Inadequate life? Evidence of consumer attitudes to product obsolescence. *J. Consum. Policy* 27(4), 421–449. <https://doi.org/10.1007/s10603-004-2284-6>
- Cooper, T., & Christer, K., 2010. Marketing durability, in: Cooper, T. (Ed.), *Longer lasting products: alternatives to the throwaway society*, 273–296. Farnham, UK: Gower.
- Cox, J., Griffith, S., Giorgi, S., & King, G., 2013. Consumer understanding of product lifetimes. *Resour. Conserv. Recy.* 79, 21–29. <https://doi.org/10.1016/j.resconrec.2013.05.003>
- Dalhammar, C., 2016. Industry attitudes towards ecodesign standards for improved resource efficiency. *J. Clean. Prod.* 123, 155–166. <https://doi.org/10.1016/j.jclepro.2015.12.035>
- Dalhammar, C., Richter, J.L., & Machacek, E., 2018. Energy Efficiency Regulations, Market and Behavioural Failures and Standardization, in: Maitre-Ekern, E., Dalhammar, C., Bugge, H.C. (Eds.), *Preventing Environmental Damage from Products – An Analysis of the Policy and Regulatory Framework in Europe*, 176–228, Cambridge University Press, Cambridge.
- Dünnhoff, E., & Palm, A., 2014. Comprehensibility of the EU Energy Label – Results of two focus groups and a representative consumer survey. *Verbraucherzentrale Rheinland-Pfalz*. https://www.verbraucherzentrale-rlp.de/sites/default/files/migration_files/media231718A.pdf (accessed 25 March 2022).
- Echegaray, F., 2016. Consumers’ reactions to product obsolescence in emerging markets: The case of Brazil. *J. Clean. Prod.* 134, 191–203. <https://doi.org/10.1016/j.jclepro.2015.08.119>
- Ertz, M., François, J., & Durif, F., 2017. How consumers react to environmental information: An experimental study. *J. Int. Consum. Mark.* 29(3), 162–178. <https://doi.org/10.1080/08961530.2016.1273813>
- Fangeat, E., & Chauvin C., 2016. Allongement de la durée de vie des produits. https://www.ademe.fr/sites/default/files/assets/documents/allongement_duree_vie_produits_2016_02_rapport.pdf (accessed 25 March 2022).

- Gfk (2017). Consumer Market Study to support the Fitness Check of Consumer Rules. Publications Office of the European Union, Luxemburg. http://ec.europa.eu/newsroom/just/item-detail.cfm?item_id=59332 (accessed 23 July 2022).
- Gåvertsson, I., Milios, L., & Dalhammar, C., 2020. Quality Labelling for Re-used ICT Equipment to Support Consumer Choice in the Circular Economy. *J. Consum. Policy* 43, 353–377. <https://doi.org/10.1007/s10603-018-9397-9>
- Gnanapragasam, A., Cooper, T., Cole, C., & Oguchi, M., 2017. Consumer perspectives on product lifetimes: a national study of lifetime satisfaction and purchasing factors. In *Product Lifetimes And The Environment 2017 Conference Proceedings*, 144–148.
- Guiltinan, J., 2009. Creative destruction and destructive creations: environmental ethics and planned obsolescence. *J. Bus. Ethics*, 89(1), 19–28. <https://doi.org/10.1007/s10551-008-9907-9>
- Haberl, H., Wiedenhofer, D., Pauliuk, S., Krausmann, F., Müller, D.B., & Fischer-Kowalski, M., 2019. Contributions of sociometabolic research to sustainability science. *Nat. Sustain.* 2, 173–184. <https://doi.org/10.1038/s41893-019-0225-2>
- Harms, R., & Linton, J.D., 2016. Willingness to Pay for Eco-Certified Refurbished Products: The Effects of Environmental Attitudes and Knowledge: WTP for Eco-Certified Refurbished Products. *J. Ind. Ecol.* 20(4), 893–904. <https://doi.org/10.1111/jiec.12301>
- Hennies, L., & Stamminger, R., 2016. An empirical survey on the obsolescence of appliances in German households. *Resour. Conserv. Recy.* 112, 73–82. <https://doi.org/10.1016/j.resconrec.2016.04.013>
- Horne, R.E., 2009. Limits to labels: The role of eco-labels in the assessment of product sustainability and routes to sustainable consumption. *Int. J. Consum. Stud.* 33, 175–182. <https://doi.org/10.1111/j.1470-6431.2009.00752.x>
- IRP, 2018. Re-defining value – The manufacturing revolution. In *Remanufacturing, refurbishment, repair and direct reuse in the circular economy*. Report of the International Resource Panel. United Nations Environment Programme, Nairobi, Kenya.
- Jacobs, K., 2018. The Influence of Product Lifetime Labelling on Purchasing Electrical Appliances among German Consumers. Presented at the Ecodesign Conference: The ecodesign directive and the circular economy: How can we move forward? Brussels.
- Jacobs, K., & Hörisch, J., 2022. The importance of product lifetime labelling for purchase decisions: Strategic implications for corporate sustainability based on a conjoint analysis in Germany. *Bus. Strateg. Environ.* 31(4), 1275–1291. <https://doi.org/10.1002/bse.2954>
- Kahlin McVeigh, M., Dalhammar, C., & Richter, J.L., 2019. Planned obsolescence – Built not to last. <https://liberalforum.eu/publication/planned-obsolescence-built-not-to-last/> (accessed 2 November 2022).
- Khan, M.A., Mittal, S., West, S., & Wuest, T., 2018. Review on upgradability – A product lifetime extension strategy in the context of product service systems. *J. Clean. Prod.* 204, 1154–1168. <https://doi.org/10.1016/j.jclepro.2018.08.329>
- Kirchherr, J., Reike, D., & Hekkert, M. (2017). Conceptualizing the circular economy: An analysis of 114 definitions. *Resources, Conservation and Recycling*, 127, 221–232. <https://doi.org/10.1016/j.resconrec.2017.09.005>
- Knight, T., King, G., Herren, S., & Cox, J., 2013. Electrical and electronic product design: product lifetime. WRAP UK.
- LE Europe, VVA Europe, Ipsos, ConPolicy, & Trinomics, 2018. Behavioural Study on Consumers' Engagement in the Circular Economy. Brussels: European Commission. https://ec.europa.eu/info/sites/info/files/ec_circular_economy_final_report_0.pdf (accessed 8 July 2022).
- Leenheer, J., Elsen, M., Mikola, N., van der Wagt, M., & Lloyd, L., 2014. Study on the effects on consumer behaviour of online sustainability information displays. Final Report prepared for the European Commission Executive Agency for Health and Consumers. <https://op.europa.eu/en/publication-detail/-/publication/87c863a3-88af-4c8a-ab47-beab72de492e> (accessed 8 July 2022).
- Leire, C., & Thidell, Å., 2005. Product-related environmental information to guide consumer purchases – A review and analysis of research on perceptions, understanding and use among Nordic consumers. *J. Clean. Prod.* 13, 1061–1070. <https://doi.org/10.1016/j.jclepro.2004.12.004>

- Levac, D., Colquhoun, H. & O'Brien, K.K., 2010. Scoping studies: advancing the methodology. *Implementation Sci* 5, 69. <https://doi.org/10.1186/1748-5908-5-69>
- Longmuss, J., & Poppe, E., 2017. Planned obsolescence: who are those planners? PLATE 2017 conference proceedings. <https://doi.org/10.3233/978-1-61499-820-4-217>
- Magnadóttir, B.G., Lien, T., Bergman, I.-M., Frenander, C., & Dreyer, R., 2017. Nordic Guidelines – Green Public Procurement: How to use environmental management systems and ecolabels in EU tenders. <https://doi.org/10.6027/ANP2017-728>
- Marcus, J.S., Zachmann, G., Gardner, S., Tagliapietra, S., & Lykogianni, E., 2020. Promoting product longevity. Final Report for the European Parliament's Committee on the Internal Market and Consumer Protection (IMCO). <https://www.europarl.europa.eu/committees/en/study-promoting-product-longevity-/product-details/20200417CAN54506> (accessed 9 July 2022).
- Maitre-Ekern, E., & Dalhammar, C., 2016. Regulating planned obsolescence: A review of legal approaches to increase product durability and reparability in Europe. *Rev. Eur. Comp. Int. Environ. Law* 25(3), 378–394. <https://doi.org/10.1111/reel.12182>
- McKenzie-Mohr, D., & Smith, W., 1999. Fostering sustainable behaviour. An introduction to community based social marketing. Gabriola Island: New Society Publishers.
- Milios, L., 2018. Advancing to a Circular Economy: three essential ingredients for a comprehensive policy mix. *Sustain. Sci.* 13(3), 861–878. <https://doi.org/10.1007/s11625-017-0502-9>
- Milios, L., 2021. Overarching Policy Framework for Product Life Extension in a Circular Economy. *Environ. Policy Gov.* 31, 330–346. <https://doi.org/10.1002/eet.1927>
- Milios, L., & Dalhammar, C., 2020. Ascending the Waste Hierarchy: Re-use potential in Swedish recycling centres. *Detritus*, 9, 27–37. <https://doi.org/10.31025/2611-4135/2020.13912>
- Mont, O., & Power, K., 2010. The role of formal and informal forces in shaping consumption and implications for sustainable society: Part I. *Sustainability*, 2(7), 2232–2252. <https://doi.org/10.3390/su2072232>
- Mugge, R., Schoormans, J.P., & Schifferstein, H.N., 2005. Design strategies to postpone consumers' product replacement: The value of a strong person-product relationship. *Des. J.* 8(2), 38–48. <https://doi.org/10.2752/146069205789331637>
- Munn, Z., Peters, M.D.J., Stern, C., Tafunaru, C., McArthur, A., & Aromataris, E., 2018. Systematic review or scoping review? Guidance for authors when choosing between a systematic or scoping review approach. *BMC Med Res Method*, 18, 143. <https://doi.org/10.1186/s12874-018-0611-x>
- Pham, M.T., Rajić, A., Greig, J.D., Sargeant, J.M., Papadopoulos, A., McEwen, S.A., 2014. A scoping review of scoping reviews: advancing the approach and enhancing the consistency. *Res Synth Methods* 5(4):371–85. DOI: 10.1002/jrsm.1123
- Prakash, S., Stamminger, R., Dehoust, G., Gsell, M., Schleicher, T., & Stamminger, R., 2016. Einfluss der Nutzungsdauer von Produkten auf ihre Umweltwirkung: Schaffung einer Informationsgrundlage und Entwicklung von Strategien gegen "Obsoleszenz"—On behalf of the Federal Ministry for Environment, Nature Conservation, Construction and Nuclear Safety. https://www.umweltbundesamt.de/sites/default/files/medien/378/publikationen/texte_11_2016_einfluss_der_nutzungsdauer_von_produkten_obsoleszenz.pdf (accessed 13 July 2022).
- Reike, D., Vermeulen, W. J. V., & Witjes, S., 2018. The circular economy: New or Refurbished as CE 3.0? Exploring Controversies in the Conceptualization of the Circular Economy through a Focus on History and Resource Value Retention Options. *Resour. Conserv. Recy.* 135, 246–264. <https://doi.org/10.1016/j.resconrec.2017.08.027>
- Richter, J.L., Tähkämö, L., & Dalhammar, C., 2019. Trade-offs with longer lifetimes? The case of LED lamps considering product development and energy contexts. *J. Clean. Prod.* 226, 195–209. <https://doi.org/10.1016/j.jclepro.2019.03.331>
- Sammer, K., & Wüstenhagen, R., 2006. The influence of eco-labelling on consumer behaviour—Results of a discrete choice analysis for washing machines. *Bus. Strateg. Environ.* 15(3), 185–199. <https://doi.org/10.1002/bse.522>
- Sircome, University of South Brittany, & University of South Bohemia, 2016. ILLC study: The Influence of lifespan labelling on consumers—On behalf of the European Economic and Social Committee (CES/CSS/1/2015). https://www.eesc.europa.eu/sites/default/files/resources/docs/16_123_duree-dutilisation-des-produits_complet_en.pdf (accessed 23 July 2022).

- Skylark, W.J., & Callan, M.J., 2021. Personal relative deprivation and pro-environmental intentions. *PLoS ONE* 16(11): e0259711. <https://doi.org/10.1371/journal.pone.0259711>
- Sønderskov, K.M., & Daugbjerg, C., 2011. The State and Consumer Confidence in Eco-Labeling: Organic Labeling in Denmark, Sweden, The United Kingdom and The United States. *Agric. Hum. Values* 28(4), 507–517. <https://doi.org/10.1007/s10460-010-9295-5>
- Swaen, V., Dupont, B., & Vanhamme, J., 2014. Labelling the durability of a product on its packaging: A pilot study. <https://www.eesc.europa.eu/en/news-media/presentations/labelling-durability-product-its-packaging-pilot-study> (accessed 7 March 2022).
- Swaen, V., Munten, P., & Vanhamme, J., 2018. Labelling the durability – the reparability of a product. <https://www.eesc.europa.eu/en/news-media/presentations/labelling-durability-reparability-product> (accessed 8 March 2022).
- Tang, E., Fryxell, G.E., & Chow, C.S.F., 2004. Visual and Verbal Communication in the Design of Eco-Label for Green Consumer Products. *J. Int. Consum. Mark.* 16(4), 85–105. https://doi.org/10.1300/J046v16n04_05
- Teisl, M.F., Rubin, J., & Noblet, C.L., 2008. Non-Dirty Dancing? Inter-actions between Eco-Labels and Consumers. *J. Econ. Psychol.* 29(2), 140–159. <https://doi.org/10.1016/j.joep.2007.04.002>
- Thøgersen, J., 2005. How may consumer policy empower consumers for sustainable lifestyles? *J. Consum. Policy* 28, 143–178. <https://doi.org/10.1007/s10603-005-2982-8>
- Van Dam, Y.K., & Reuvekamp, M., 1995. Consumer knowledge and understanding of environmental seals in the Netherlands. In F. Hansen (Ed.), *European advances in consumer research* (Vol. 2, pp. 217–223). Provo: Association for Consumer Research.
- van den Berge, R., & Thysen, T., 2020. State-of-the-art knowledge on user, market and legal issues related to premature obsolescence. *Premature Obsolescence Multi-Stakeholder Product Testing Program (PROMT) – Deliverable 2.6*. https://prompt-project.eu/wp-content/uploads/2020/07/PROMPT_20200430_State-of-the-art-overview-of-the-user-market-and-legal-aspects.pdf
- van den Berge, R., Magnier, L., & Mugge, R., 2021a. A poorly educated guess: consumers’ lifetime estimations, attitudes towards reparability, and a product lifetime label. In *Product Lifetimes And The Environment 2021 Conference Proceedings*. <http://hdl.handle.net/10344/10181>
- van den Berge, R., Magnier, L., & Mugge, R., 2021b. Too good to go? Consumers’ replacement behaviour and potential strategies for stimulating product retention. *Curr. Opin. Psychol.* 39, 66–71. <https://doi.org/10.1016/j.copsyc.2020.07.014>
- van der Ven, H., 2019. *Beyond Greenwash? Explaining Credibility in Transnational Eco-Labeling*. Oxford University Press, UK: Oxford.
- Van Nes, N., & Cramer, J., 2005. Influencing product lifetime through product design. *Bus. Strateg. Environ.* 14(5), 286–299. <https://doi.org/10.1002/bse.491>
- VHK, 2016. *Ecodesign impacts accounting – Annual Report 2016*. https://ec.europa.eu/energy/sites/ener/files/documents/eia_ii_-_status_report_2016_rev20170314.pdf (accessed 25 July 2022).
- Ward, D.O., Clark, C.D., Jensen, K.L., Yen, S.T., & Russell, C.S., 2011. Factors Influencing Willingness-to-Pay for the ENERGY STAR® Label. *Energy Policy*, 39(3), 1450–1458. <https://doi.org/10.1016/j.enpol.2010.12.017>
- Wieser, H., & Tröger, N., 2018. Exploring the inner loops of the circular economy: Replacement, repair, and reuse of mobile phones in Austria. *J. Clean. Prod.* 172, 3042–3055. <https://doi.org/10.1016/j.jclepro.2017.11.106>
- Wilson, G.T., Smalley, G., Suckling, J.R., Lilley, D., Lee, J., & Mawle, R., 2017. The hibernating mobile phone: Dead storage as a barrier to efficient electronic waste recovery. *Waste Manag.* 60, 521–533. <https://doi.org/10.1016/j.wasman.2016.12.023>